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SOME EARLY STAGES OF BRENTHIS MONTINUS SCUDDER. (LEPIDOPTERA—NYMPHALIDAE).

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The life history of *Brenthis montinus* has long been a problem taxing the ingenuity of lepidopterists. Scudder made repeated efforts to secure the egg but never observed a female ovipositing. The egg figured in "The Butterflies of the Eastern United States" (Vol. 3, plate 64 f.38 and plate 67 f.16) was removed from the body of the ♀ (1863 Bost. Journ. Nat. History VII: 626; see also 1874 Geology of New Hampshire 339, 354).

On August 16th, 1933, eleven specimens of *montinus* were taken on Mt. Washington, New Hampshire and confined over an alpine golden rod (*Solidago cutleri* Fernald) to the flower of which they are very partial, mountain cranberry (*Vaccinium vitis-idaea* L.), a species of blueberry or huckleberry (*Ericaceae* sp.) choke cherry (*Padus nana dukoi*) and a species of willow (*Salix*) on the trial and error theory. The following day, a species of violet (*Viola* sp.) was added. On the 21st, about six (6) eggs were observed on the petals and pods of *S. cutleri* and the next day, eight (8) more eggs were seen. Altogether about twenty-three (23) eggs were obtained, mostly on *cutleri* but some on the sides of the breeding cages. None was oviposited on any other plant.

The first larvae were first observed on September 1st when two out of five eggs, placed in a test tube on August 27th, hatched. Later, eight (8) more eggs hatched in test tubes and five (5) larvae were found on the bottom of the breeding cages. Some eggs were partly eaten but there was no evidence that any of the plants had been touched. Apparently the larvae hibernate immediately after leaving the egg. Some of these larvae were placed in alcohol for future study and fifteen (15) in paper pill boxes and placed in an electric refrigerator.

The following April 1934, the larvae were removed from the ice-box and all were found to be dead although some did not appear to have been dead very long.

That summer, August 1st, eight (8) more specimens of *montinus*, including a pair taken in copulation, were confined over *S. cutleri*. While collecting these specimens, a female was observed apparently ovipositing on the ground but no egg was found. Since no one seems to have observed ovipositing on any plant it may well be that the eggs are dropped on the ground and that they fall between the dry moss, lichen, leaves, twigs and rubbish, where the larvae, upon emerging, hibernate.

The first eggs were observed this season on August 3rd. By August 7th the ♀ taken in copulation had laid forty (40) eggs, mostly on the sides of the breeding cage. This ♀ laid several additional eggs before dying on the 18th, having lived seventeen (17) days in captivity, during which time she was fed exclusively on fresh peach juice. The first larva of this batch was observed in

one of the test tubes on August 19th. It was eating its shell. These larvae continued to emerge for several days and on September 12th there were about sixty (60) of them.

Most of these larvae were placed in small vials, three (3) to each, and the corks were moistened, it being assumed that one reason why no larvae survived the previous winter was because of lack of moisture. They were also placed in an electric refrigerator. The corks were moistened several times during the winter.

On March 24th, 1935 thirteen (13) larvae were removed from the vials and two were found to be alive. They both took water readily but would not eat any of the plants heretofore mentioned or local violet or species of willow. No more were removed until April 29th as an effort was being made to obtain several Arctic species of willow but by the time these plants arrived, the remaining fifty-five (55) larvae were dead although one did not appear to have been dead very long.

While the egg of *Brenthis montinus* has been described and figured (l.c.) its color was stated to be white. The egg when laid is flesh color. Within a few days it becomes orange and finally nearly white before hatching, when the dark head of the larvae may be seen through the micropyle. The eggs are very soft and difficult to handle. The photographed specimen had been in alcohol (95%) and somewhat lost its shape, which is symmetrical.

The following is a brief description of the larva, first instar; 2-2.25 mm, cylindrical, flat underneath, head sparsely covered with short hairs, brown mask covering the upper portion and eyes but not mouth parts which are concolorous with body—body yellow with brown setae standing out from brown tubercles. Eyes black almost half circle with five light yellow spots on circumference and one at radius, the arc being downward. First thoracic segment with an oval brown patch back of the head extending either side of dorsal line with eight setae arising from two lines of tubercles, these setae bending forward as do all others on this segment, below on either side of dorsal line are six tubercles in pairs becoming smaller from the top down to near the forelegs, each tubercle with one seta, the middle pair having a small tubercle in back of it without seta; forelegs with about ten short hairs and armed with claws. Second and third thoracic segments with five rows of tubercles counting from dorsal line, first two with one seta each, third with two, one bending forward and the other backward; fourth with five, pointing in as many directions, and the fifth with one; the tubercles are slightly staggered; forelegs similar to those on first thoracic segment. First and second abdominal segments similar to second and third thoracic segments, the third tubercle having only one seta; the first abdominal segment has four and the second, six small tubercles under the body, with one hair each; the third, fourth, fifth and sixth abdominal segments with only the first four rows of tubercles, the first three with one seta each and the fourth with five setae; the prolegs on these segments having several short hairs each and terminating on the bottom with five to six brown hooks. Seventh, eighth and ninth abdominal segments similar to first and second abdominal segments with four tubercles, the setae bending backward, except the first tubercle on the seventh segment which bends forward as do all previously mentioned setae on the first, second and third rows of tubercles on the

abdominal segments; the seventh abdominal segment has four small tubercles on the underside of body with one hair each and the eighth has two similar tubercles; the tenth abdominal segment with an oval brown patch on the dorsum similar to, but smaller, than the patch on the first thoracic segment, the setae arising out of six tubercles in two lines, of two and four respectively, setae pointing backward; the anal legs have about nine brown hooks and about five hairs each; the brown color of the fourth row of tubercles on the first to eighth abdominal segments is split by the body color in the shape of an inverted "v"; on these segments, above the fourth tubercle, there are small light brown spots, without setae, those on the first and eighth segments being about twice the size of the others and the one on the eighth segment being pupiled with the body color.

LABORATORY BREEDING OF ASCOGASTER CARPOCAPSAE VIER. WITH NOTES ON BIOLOGY AND LARVAL MORPHOLOGY.

BY H. R. BOYCE,

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INTRODUCTION

Ascogaster carpocapsae Vier. was not known to have spread naturally over the mountain barriers into the apple growing districts of British Columbia, and it was considered that the introduction of this species might aid in the control of the codling moth (*Cydia pomonella* Linn.) which has become a serious pest in that area during recent years.

A number of *Ascogaster* were collected in the Niagara district in Ontario and the biology and artificial rearing were studied. The *Ascogaster* secured from the laboratory rearing were shipped to various districts of British Columbia and liberated for three successive years, commencing in 1933.

HOSTS AND DISTRIBUTION

It is believed that *Ascogaster carpocapsae* Vier. was introduced into America from Europe along with the codling moth (*Cydia pomonella* Linn.), since it is considered to be synonymous with *Ascogaster quadridentatus* Wesm. of Europe. Its distribution is now quite general over the eastern half of this continent. In addition to the codling moth, it has also been found attacking the Oriental fruit moth (*Cydia molesta* Busck.), the striped peach worm, (*Gelechia confusella* Cham.), the strawberry leaf roller, (*Ancylis comptana* Froel.), and the grapeberry moth (*Polychrosis viteana* Clem.). In Europe a large number of hosts have been recorded. This parasite has been introduced into the apple growing districts of the Western United States, and has now become well established in some areas there.

GENERAL BIOLOGY

Ascogaster adults mate almost immediately after emerging from the cocoons. When supplied with cane sugar and water they feed readily and will live for a number of days, but in the absence of food and water at a temperature of 80°F., they live only twelve to twenty-four hours. The males live from thirty-nine to fifty days and the females from thirty-three to sixty days, when stored in an ordinary ice box and brought to room temperature of 70°F., and fed for one hour daily.

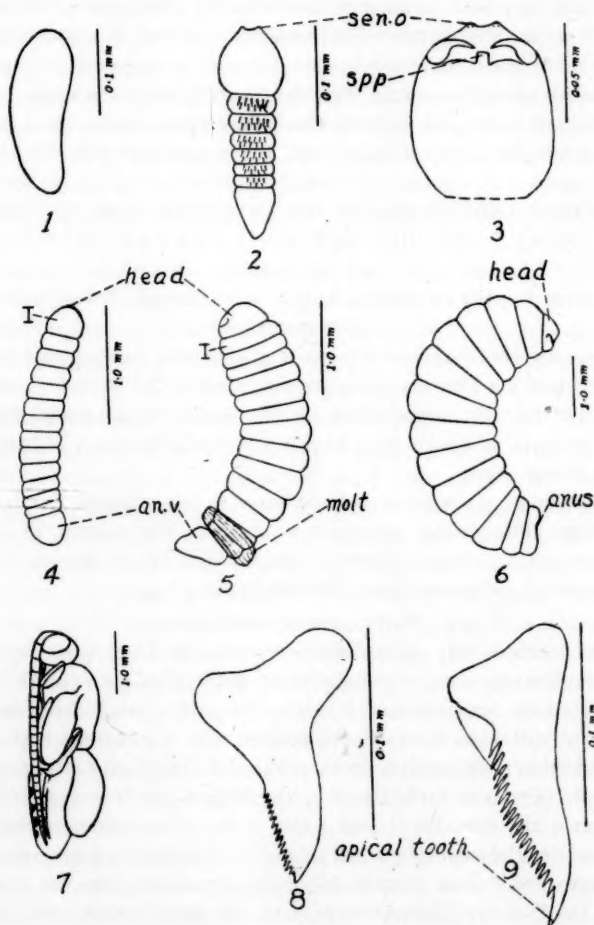


Fig. 1.—*Ascogaster carpocapsae* Vier. egg. Fig. 2.—Dorsal view of first stage larva eight hours after hatching showing dorsal spines, sensory organs (Sen. O.). Fig. 3.—Ventral view of head of newly hatched larva, showing mandibles, sensory organs (Sen. O.) spatulate process. (Spp.). Fig. 4.—Mature first stage larva showing minute head, anal vesicle. I, first body segment. Fig. 5.—Early second stage larva with moult of first stage still attached above anal vesicle (An. v.) I, first body segment. Fig. 6.—Mature third stage larva. Fig. 7.—Pupa two days old. Fig. 8.—Mandibles of second stage larva. Fig. 9.—Mandibles of third stage larva illustrating distinct apical tooth.

The adults are positively phototropic to a very marked degree, and this facilitates handling them in the laboratory, especially when transferring them into various containers.

Ascogaster is a larval parasite but it oviposits in the egg stage of its hosts. The females usually commence oviposition within 24 hours after fertilization and will oviposit readily in any stage of host egg. In many cases females attempt to oviposit in the shells of hatched eggs or in places from which the host eggs have been removed.

The eggs are laid singly within the host egg, but a female will frequently return and oviposit in host eggs which have been parasitized previously by herself or other females. If the host egg is in the early stages of development the parasite egg is found in the cytoplasm, but when the host embryo had developed 38 hours or more at 80°F., the *Ascogaster* eggs were frequently deposited in the developing embryo. Rosenberg (1934) states that with *A. quadridentatus* Wesm., the parasite egg is deposited in the cytoplasm of the host egg and not in the developing embryo. A close study of a number of sections of host eggs parasitized when the embryo was well developed show conclusively that *A. carpocapsae* eggs are frequently deposited in the embryo.

DESCRIPTION OF STAGES

Length of egg 0.15 to 0.18 mm., width .04 to .06 mm. (Figure 1.) At a temperature of 80°F. hatching takes place within twenty-four to twenty-six hours.

The newly hatched larva (Figure 2) is on the average 0.2 mm. long by .06 mm. wide, and has 8, more or less, distinct segments in addition to the head. The head is very large in proportion to the other segments and is widest at a point two thirds of its length from the anterior end. The anal segment is larger than the other abdominal segments, more or less irregular in general outline and is, in reality, the fusion of several segments. A varying number of short spines, pointing in a posterior direction, are arranged in several irregular rows across the dorsal surface of all but the anal segment.

The differentiation of the first stage larval segments appears to be a gradual process and the mature first stage larva (Figure 4) differs greatly from the newly hatched larva. During the course of the first instar, additional segments appear so that the mature first stage larva consists of a head, now minute in comparison with the other segments, a large rounded first body segment and 12 other segments, followed by the vaginated rectum, as described by Rosenberg. The duration of this stage depends upon the rate of development of the host and it is mature when the host cocoon is spun. Mature first stage larvae measure on the average 2.05 mm. in length by 0.32 mm. in width. (Fig. 4).

The mature second stage larva is from 3.2 to 4.5 mm. in length, and from 0.5 to 1.0 mm. in greatest breadth. (Fig. 5). The head is small and the labium appears as a transverse ridge. The mandibles are stout but very slightly sclerotized and have a single row of serrations on the posterior ventral angle. These serrations appear to be more numerous and more prominent than those of *A. quadridentatus*, as illustrated by Rosenberg. The larva consists of a head, 13 body segments, and an evaginated rectum.

Cox (1932) describes four larval stages of *A. carpocapsae*. He states that the second stage is without mandibles and of short duration. The present writer found no stage without mandibles, and no evidence of more than three stages. Rosenberg describes only three stages for *A. quadridentatus*.

The third stage larva has a head and thirteen body segments, and is without the evaginated rectum. This stage averages 5.4 mm. in length by 1.45 mm. in greatest width. The head capsule compares feature for feature with the description of that of *A. quadridentatus*, as described by Rosenberg, with the exception that the mandibles appear to have larger serrations and a very characteristic apical tooth. (Fig. 9). This larval stage is of short duration and the habits of the larva change considerably. It emerges from the host and feeds with head embedded in the soft tissues until all but the exoskeleton of the host is consumed.

The parasite cocoon is spun within the host cocoon and is glossy white when completed. Pupation then takes place and at a temperature of 80°F. the pupal stage requires from eight to twelve days. The average cycle from egg to adult with the fruit moth as host is twenty-eight to thirty days, at a temperature of 80°F.

LABORATORY BREEDING

The laboratory breeding of *Ascogaster* was begun in the fall of 1932 with a stock of the parasite which was secured from parasitized Oriental fruit moth larvae, collected in the Niagara district. Some breeding was carried on with the codling moth as host, but, as only one larva matured from each apple, while the fruit moth was reared at the rate of eight to ten larvae per apple, it was decided to use the later host in order to obtain a considerable economy in labour, food material, and space.

The oviposition cage used in the parasite breeding was of wooden framework, covered on the top and three sides with fine cheesecloth. A sliding glass front was provided to permit observation of the activity and oviposition habits of the insect. The bottom of the cage was of solid wood and this was covered with sand, which was moistened daily. A small slender jar containing several cubes of granulated sugar was kept in the cage to provide the parasites with food. The host eggs, on strips of waxed paper, were pinned to the side of the cage through which the most light entered. Bright sunshine with a room temperature of 70°F. provided the best conditions for oviposition. A bright artificial light and a room temperature of 75°F. appeared to be the optimum conditions on dull days. During the first year's work the eggs used were sixteen to eighteen hours old and were exposed to the *Ascogaster* females for periods of two to six hours. The eggs were then removed to a petri dish or some other moist chamber. When ready to hatch they were transferred to apples which were lightly scored with a scalpel to facilitate entrance of the larvae. The infested apples were handled in gem jars, wire screened metal trays, or in milk pans, the bottoms of which had been replaced by wire screening. After the host larvae were mature and spun up in strips of corrugated paper, provided for the purpose, they were transferred to ordinary tumblers or gem jars for emergence.

In 1934, the breeding stock was secured from codling moth larvae. This material was secured through the courtesy of the United States Department of Agriculture.

The breeding technique was the same as in 1933 with the exception that several lots of eggs were exposed for parasitism after developing thirty-eight to forty-two hours. Recent work with *Chelonus annulipes* Wesm., a corn borer parasite, had shown that the use of corn borer eggs in later stages of development gave a greater parasite emergence. *Ascogaster* and *Chelonus* are very similar in their habits, so an experiment was carried out with a number of lots of the older fruit moth eggs. An increase in parasitism was obtained in this material and 22 per cent more parasites were secured when the older eggs were used.

The breeding technique was altered in 1935 by using only host eggs which had developed thirty-eight to forty-eight hours before exposing them to the parasites. In all other respects the technique remained the same as in 1934. The results were most satisfactory and the propagation of this species can now be conducted on a large scale very economically.

SHIPPING AND LIBERATIONS

Transportation of the parasites to British Columbia in 1933 was effected entirely by railway express. Some were shipped in specially constructed iceless containers, and others in 3-inch vials packed in an ice box. Both methods gave equally good results and in 1934 the iceless containers were used exclusively, as they were cheaper to ship and more adaptable for handling large numbers of the parasite. The shipments arrived in British Columbia in poor condition, however, owing to the extremely hot weather and the method of handling by the Express Company, which carried them across the Prairies in sealed cars.

Several methods of shipment were experimented with in 1935. A test shipment by air mail from Belleville to Victoria was not successful, as only 17 of the 100 *Ascogaster* in this lot were alive when they were unpacked for liberation. The mortality in this case was probably due in part to an unexplained delay, as it required four days for the trip, this being but one day less than required for express shipments.

A check lot of 950 parasites were sent to Victoria by express in a container without ice. When this container was opened at its destination only 300 *Ascogaster* were alive. The mortality in this lot was much higher than that in similar lots shipped in iced containers.

Considerable mortality in the early shipments of 1935 appeared to be caused by the use of a mechanical collector. All of the later lots which were collected with an ordinary mouth sucker reached their destination in much better condition.

Finally a shipping cage was developed which has proven very satisfactory for the transportation of *Ascogaster* across the continent. This cage consists of a light wooden frame covered on all sides with fine cheesecloth. Several rods of light wire are inserted in opposite sides of the frame and a ladder of cheesecloth is suspended over these rods. Several moist rolls of dental cotton are inserted in the cage at the time the parasites are placed in it. The cage is then packed in a metal ice box and partially insulated from contact with the metal sides by heavy pieces of cardboard. The ice box is re-iced as required by the transportation company enroute.

All liberations were made by officers of the Dominion Entomological Laboratories at Vernon and Victoria, B. C. In 1933, of the 1,480 *Ascogaster* shipped from Belleville, 1,097 were liberated in the Kelowna district. In 1934, 2,065 were shipped and 421 reached their destination alive. These were also liberated in the Okanagan Valley. During the season of 1935 a total of 3,599 *Ascogaster* was shipped to the Okanagan Valley and, of these, 2,264 were liberated. Shipments to Victoria totalled 2,705 parasites, of which 1,739 were released in several orchards on Vancouver Island.

RECOVERIES

Mr. W. Downes, of the Victoria, B. C. laboratory, has reported recoveries of a considerable number of *Ascogaster* larvae and pupae from banded trees in an unsprayed orchard during the 1935 season. He also reported that collections from a sprayed orchard at another liberation point showed no parasitism by *Ascogaster*. No reports have been received of recoveries in the Okanagan Valley, and as far as the writer is aware, no attempts have been made to make collections in that area.

SUMMARY

Nine thousand, eight hundred and forty-nine adults of *Ascogaster carpocapsae* Vier., which were reared in the laboratory, have been despatched to several areas in British Columbia to aid in the control of the codling moth (*Cydia pomonella* Linn.).

This parasite is widely distributed throughout Europe and Eastern North America, and is a parasite of a number of species of Lepidoptera.

A short account of the biology and a description of the various stages is given chiefly as a comparison with studies made by previous workers on this parasite.

The breeding technique is described in full and a detailed account is given of shipping methods and liberation areas.

Recoveries of *Ascogaster* were made from liberations of 1935 in an unsprayed orchard near Victoria, B. C.

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NOTES ON SOME SPECIES OF ELATERIDAE (COLEOPTERA).*

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Eanus Lec.

Following are some additions and corrections to my arrangement of our species of *Eanus* (1930, Can. Ent. LXII, 161). *Diacanthus parvicollis* Mann. (1853, Bull. Moscou XXVI, 230), from the Kenai peninsula of Alaska, is undoubt-

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture. Ottawa.

edly the male of *decoratus* Mann. As pointed out by Mr. Fall (1934, Jour. N. Y. Ent. Soc. XLII, 36), *subarcticus* Brown is a synonym of *estriatus* Lec.

***Eanus decoratus* Mann.**

Mr. Fall, comparing specimens of the European *costalis* Payk. with the American *decoratus*, has found himself unable to form a definite conclusion regarding the validity of the latter. I have compared a single male of *costalis* with sixty-six males and nine females of *decoratus* with the following results. In *costalis* the pronotal sides are rather strongly arcuate, much more strongly so than in *decoratus*, and are more strongly sinuate before the posterior angles; the latter are a little more slender than in *decoratus* and, at the base of the angle, the pronotal disk becomes convex more abruptly than in the American form. These characters are quite evident and are constant in all the specimens of both sexes. Those of the angles were noted by Mannerheim (1853, Bull. Moscou XXVI, 229). The third antennal segment of *costalis* is smaller as compared to the other segments, measuring two-thirds the length of the fourth against three-fourths to four-fifths in the males of *decoratus*. In *costalis* the propleura are polished, not alutaceous, and are supplied with punctures which are deep and well defined like those of the prosternum. In *decoratus* the propleura are alutaceous, and the punctures are shallow, poorly defined, and less distinct than those of the prosternum. In *costalis* the elytral striae are quite evident on all parts of the disk and are not more strongly impressed at base; in *decoratus* the striae are distinct on the basal declivity only and are not traceable on the disk. Because of the constancy of these characters in the specimens at hand, I believe they will be found to hold in other material. In the specimen of *costalis* and in six or seven males of *decoratus*, there are no traces of the yellow spots which are more or less evident in the other males on the base and apex of each elytron. The specimen of *costalis* measures 8.3 mm.; all but one of the *decoratus* males are somewhat smaller.

***Eanus albertanus* Brown and *granicollis* Van Dyke.**

The types of *albertanus* are males from Banff, Alta. I now have numerous specimens, including a single female, from Red Pass and Mt. Revelstoke, B. C. This female is larger than males, measuring 7 mm., and each of its elytra bears a small basal and a subapical yellow spot as in some males. I have a male specimen taken at Grouse mountain, 4200 ft., Vancouver, B. C. (H. B. Leech), which I refer with confidence to *granicollis* Van Dyke (1932, Proc. Cal. Ac. Sci. XX, 435). This species was described from Mt. Rainier, Wash., and was recorded from Mt. Adams, Wash., and Mt. Hood, Ore. It was said to be characterized by the close puncturation of the head and pronotum. The specimen at hand resembles *albertanus* very closely in size, form, and color, being marked with a small yellow spot at the base of each elytron. It differs in having the pronotal punctures very close, none being separated by distances greater than their own diameters, and in having the third antennal segment four-fifths as long as the fourth; in *albertanus* many of the punctures are separated by distances equal to or greater than their own diameters as in *estriatus*, and the third antennal segment is fully as long as the fourth in both sexes. It will be noted that all known specimens of *albertanus* are from the Rocky Mountains and that *granicollis* occurs in the Cascade Range.

***Eanus striatipennis* n. sp.**

Male. Length 9 mm.; width 3.1 mm. Body form much as in *decoratus*. Head, pronotum, and venter dark metallic green with cupreous reflections; elytra bright metallic green; antennae black; legs blackish, the tarsi paler. Vestiture scarcely evident on the dorsum, much sparser than in the other species; distinct on the venter.

Head three-fifths as wide as the pronotum, closely but not coarsely punctate. Antenna surpassing the apex of the posterior pronotal angle by a distance subequal to the length of two segments; the third segment scarcely longer than wide, strongly triangular, similar to the second in length, width, and form, one-half as long as and two-thirds as wide as the fourth segment, the latter three-fourths as wide as long; the intermediate segments distinctly longer than wide, the eleventh two-fifths as wide as long.

Pronotum four-fifths as long as wide; the sides strongly arcuate near the anterior angles, very feebly so at middle, rather feebly sinuate before the posterior angles; each of the latter supplied with a rather strongly elevated but very blunt carina; the punctures of the disk like those of the head, separated by distances subequal to their own diameters. Scutellum not strongly but distinctly sulcate on the median line.

Each elytron with nine entire striae; these fine, well impressed, closely but not coarsely punctate; the intervals scarcely convex except at base, finely and rather sparsely punctate, very distinctly subrugose. Venter closely punctate, the punctures not coarse, finer on the propleura, the latter and the sides of the abdomen alutaceous. Aedeagus as figured, the apex of the median lobe broken in the type.

Female. Length 11 mm.; width 4 mm. Entire dorsum cupreous. Head half as wide as the pronotum. Antenna failing to attain the apex of the posterior pronotal angle by a distance equal to the length of two segments; the third segment two-thirds as long as and two-thirds as wide as the fourth segment, the latter four-fifths as wide as long, the intermediate segments distinctly wider than long, the eleventh two-thirds as wide as long. Pronotum three-fourths as long as wide, the sides strongly and evenly arcuate. Abdomen sparsely punctate at middle, its sides and the propleura not distinctly alutaceous.

Holotype—♂, Mara Mt., B. C., 6000 ft., June 26, 1929, (Edwards); No. 3894 in the Canadian National Collection, Ottawa.

Allotype—♀, Mt. Hood, Ore., July, 1927, (Darlington); in the Museum of Comparative Zoology.

This fine species agrees in body form with our species of *Eanus* in every essential respect; otherwise it has little in common with them. It falls in couplet 40 of Dr. Van Dyke's key with species to which it is not closely allied. It is not closely allied to those species of *Ludius*, such as *appressus* Rand., which approach *Eanus* in the form of the body, and I believe there can be no doubt that its true relationships are with *Eanus*. I note that in *striatipennis* and in the other species of *Eanus*, the pronotal base is not incised on each side as in most species of *Ludius*. Among the species of *Ludius* known to me, the incisures are present except in *divaricatus* Lec., *rotundicollis* Say, *sulcicollis* Say, the closest allies of those species, and in

opaculus Lec. I am indebted to Mr. Hugh B. Leech for the holotype of *striatipennis*.

Following is a revised key to the American species of *Eanus*.

1. Antennae black throughout; length 7 mm. or more 2.
Antennae pale at base; size usually smaller 3.
2. Dorsum strongly metallic; elytra distinctly striate, third antennal segment scarcely longer than wide. Ore., B. C. *striatipennis* n. sp.
Dorsum with aeneous lustre; elytral striae obsolete; third antennal segment almost twice as long as wide. Alaska to Que. *decoratus* Mann.
3. Each elytron with three moderately large, very conspicuous, yellow spots. Que., Labr. *maculipennis* Lec.
Elytral spots reduced in number, small, or absent 4.
4. Each elytron with a pale area at base, this not sharply delimited, without subapical pale spots, the lateral margin always pale at base; body more elongate. Lake Superior, Que. *estriatus* Lec.
Each elytron immaculate or with from one to three small yellow spots 5.
5. Many of the pronotal punctures separated by distances greater than their own diameters; third antennal segment fully as long as the fourth. Alta., B. C. *albertanus* Brown.
Pronotal punctures closer, separated by distances not greater than their own diameters; third antennal segment four-fifths as long as the fourth. Ore. to B. C. *granicolis* Van Dyke.

***Agriotes opaculus* Lec.**

Agriotes montanus Lec.

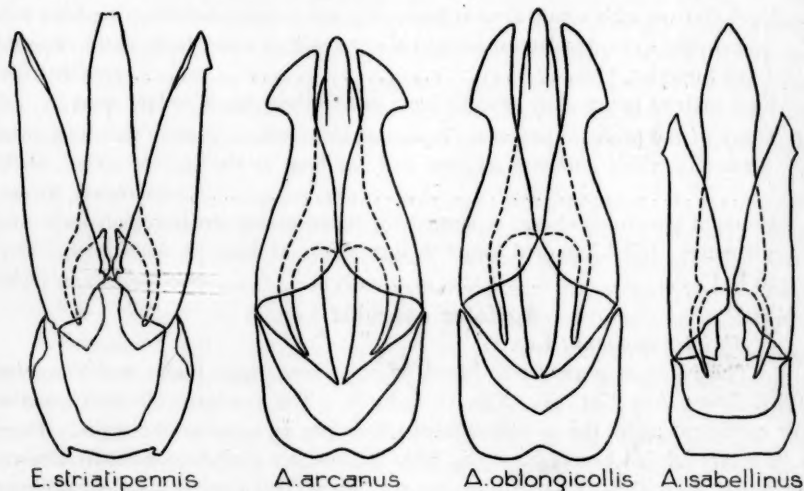
The name *montanus* was based on specimens from Idaho and Wyoming (1884, Trans. Am. Ent. Soc. XII, 16 and 18). The Leconte collection contains four specimens under the *montanus* label which may be considered cotypes. Three of these are labeled Como, S. Wyo., 8000 ft., and are *Dalopius mirabilis* Brown. The fourth is from Rock Creek, Owyhee Co., Idaho Terr., and is a faded specimen of *Agriotes opaculus* Lec. In his description of *montanus*, Leconte states that the antennae do not attain the hind angles of the thorax and that the coxal plates are abruptly broader internally, the free angles being nearly rectangular. These are characters of *opaculus*, and it appears that the description was based on the Idaho specimen. In couplet 15 of the key, *montanus* is said to have the antennae longer than the head and thorax; this can apply to *mirabilis* only. In view of the fact that the Idaho specimen fits the description, I believe that it should become the lectotype of *montanus* and so designate it; *montanus* then falls as a synonym of *opaculus*.

***Agriotes isabellinus* Mels., *oblongicollis* Mels., *arcanus* Brown**

There seems to be considerable confusion regarding the identity of these species. Mr. Fall has placed *arcanus* as a synonym of *isabellinus* (1934, Pan-Pac. Ent. X, 173) but is surely in error. The type series of *arcanus* came from Pt. Pelee, Leamington, and Strathroy, Ont., and Sioux City, Ia. I have seen no specimens from Pennsylvania or from any other localities. Melsheimer's types were from Pennsylvania, and it seems reasonable to apply his names to species

which, judging from my material, are common in that state and which satisfy his descriptions.

According to the original description (1845, Proc. Ac. N. S. Phila., 218), *isabellinus* is brownish-yellow, measures about 9.3 mm., has short antennae, dense and profound pronotal punctures, and sub lanceolate coxal plates. Only large females of the species described below as *isabellinus* meet these requirements. This species is often paler than the others and is the only one in which the coxal plates are feebly and gradually dilated and the pronotal punctures deep. It is represented in the collection before me by twenty-seven specimens from Mt. Alto, Pittsburg, and Hummelstown, Pa.; Olcott, N. Y.; Madison, Wis.; and Prince Edward Co., Ont. It was identified as *oblongicollis* by Leconte (1884, Trans. Am. Ent. Soc. XII, 16) but is closely allied to neither of the other species.



Melsheimer described *oblongicollis* as a darker species with the antennae longer than the thorax and the coxal plates abruptly dilated. Both *oblongicollis*, as here recognized, and *arcanus* satisfy the description. As here recognized, *oblongicollis* differs from *arcanus* only as noted in the original description of the latter (1933, Can. Ent. LXV, 178). It is evidently the species considered *oblongicollis* by Candeze (1863, Mon. Elat. IV, 402) and is represented in the collection before me by twenty-five specimens from Dauphin, Linglestown, Clarks Valley, Inglenook, and Pittsburgh, Pa.; Fairmont, W. Va.; Sherborn, Mass.; Rocky Bottom, S. C.; Trenton, Ont.; St. Hilaire and St. Gregoire, Que.

The three species may be separated by the following table.

1. Antennae shorter, not extending beyond the apex of the posterior pronotal angle, segments two and three together distinctly longer than the fourth in both sexes. Punctures of head and pronotum deep, not umbilicate. Carina of each posterior pronotal angle close to the lateral margin. Propleura polished, their punctures deep, rather sparse. Metasternum and abdomen with the punctures coarser and less dense. Posterior coxal plate feebly and

- gradually widened to the trochanter. Aedeagus as figured. *isabellinus* Mels. Antenna extending beyond the apex of the posterior pronotal angle in males and most females, segments two and three together equal in length to the fourth in the male, a trifle longer in the female. Head and pronotum with shallow, umbilicate punctures. Carina of each posterior pronotal angle distant from the lateral margin. Propleura with shallow, very dense punctures. Metasternum and abdomen with the punctures finer and very dense. Posterior coxal plate strongly and rather abruptly widened at middle. Median lobe of aedeagus extending slightly beyond the apices of the lateral lobes . . 2.
2. Pronotum with the punctures umbilicate at middle as on the sides. Antennae slightly longer. Aedeagus with the apical portion of each lateral lobe much longer as figured *oblongicollis* Mels. Pronotum with the punctures simple at middle, umbilicate on the sides. Antennae slightly shorter. Aedeagus with apical portions of the lateral lobes short as figured *arcanus* Brown.

***Blauta falli* n. sp.**

Male. Length 11 mm.; width 3 mm. Subcylindrical; the pronotum more convex, the body form otherwise as in *cribraria* Germ. Black; the vestiture blackish; the body subopaque above, shining beneath.

Punctures of the head coarse, shallow, dense and in part confluent. Antenna a little less slender, but otherwise as in *cribraria*, just attaining the apex of the posterior pronotal angle; the second segment two-thirds as long as wide, three-fourths as long as and four-fifths as wide as the third; the third segment three-fourths as long as wide, three-fifths as long as and three-fourths as wide as the fourth; the second and third segments combined equal in length to the fourth; the fourth segment equal in length and width, the eleventh one-third as wide as long.

Pronotum as wide as the length of its median line; the sides straight and parallel at middle, broadly arcuate in anterior fourth, broadly sinuate before the posterior angles; the latter bluntly carinate. Disk with coarse, shallow punctures separated by very narrow, polished intervals; the punctures not less dense at middle. Elytra with the striae and intervals moderately punctate, the latter more convex than in *cribraria*. Sculpture beneath as in *cribraria*. Posterior coxal plate with its margin neither toothed nor bisinuate but simple; tarsal segments slightly less elongate than in *cribraria*, their lobes as in *cribraria* but larger, the lobe of each third segment extending almost to the apex of the fourth segment. Aedeagus as in *cribraria* but with the median lobe much wider.

Holotype—♂, Miami, Florida, September, 1923; No. 4076 in the Canadian National Collection, Ottawa.

This species may be distinguished without difficulty by its color, very densely punctate pronotum, simple coxal plates, and distinctly lobed tarsi. Except as noted above, it agrees well with *cribraria* in all of its characters. It is evidently the undescribed species referred to by Mr. Fall in his discussion of *Megapenthes sturmii* Germ. (1934, Jour. N. Y. Ent. Soc. XLII, 14).

According to Candeze and subsequent authors only segments two, three, and four of the anterior tarsi bear lobes in *Blauta*. In the specimens before me,

all of which are males, the second, third, and fourth segments of all other tarsi are lobed like those of the anterior pair, and in addition a very small, indistinct lobe is evident on the first segment of each anterior tarsus. In *cribraria* all the lobes are very small and, as they are more or less obscured by the tarsal vestiture, they are observed often with difficulty.

NEW LEAFHOPPERS FROM THE WESTERN UNITED STATES
(HOMOPTERA-CICADELLIDAE).

BY R. H. BEAMER,

Kansas University, Lawrence, Kan.

Types of the following new species of Cicadellidae are in the Snow Entomological Collection, University of Kansas, Lawrence, Kansas.

***Hebecephalus hiliaris* n. sp.**

Resembling *H. crassus* (DeL.) but head more roundly blunt, female last ventral segment with median lobes sharp instead of rounded, and male style with foot distinctly boot-shaped. Length 3.25 mm.

Color. Cinereous with fuscous markings. Vertex with typical three pairs of spots. Pronotum and scutellum more or less irrorate with brown. Veins of elytra light more or less regularly margined with brown. Venter more or less infuscated.

Structure. Vertex bluntly rounded, distinctly wider between the eyes than median length. Elytra longer than abdomen in both sexes.

External genitalia. Female last ventral segment with lateral angles prominent, posterior margin deeply excavated to two large, sharp, median lobes separated by a broad mesal notch. Male valve about as wide again as long, broadly rounded. Plates slightly wider at base than valve. Lateral margins almost straight to truncate tips, mesal margin rounded, decidedly the longer. Postero-ventral corner of pygofer with medium hook.

Internal genitalia. Aedeagus with rather short, dorsally curved shaft with medium sized sagittate apex. Foot of style with deep serrated notch on outer margin.

Holotype, male, *allotype*, female, Laramie, Wyoming, June 23, 1935, Jack Beamer. Numerous paratypes same place collected by Jack and R. H. Beamer.

***Hebecephalus balli* n. sp.**

Resembling *H. scriptanus* Oman but markings of vertex not a definite chain and last ventral segment of female almost severed mesally by a large notch. Length 2.5—3.00 mm.

Color. Ground color cinereous. Vertex with spot either side apex, a transverse mesally broken band between ocelli, and two longitudinal basal dashes either side of the median line, fuscous. All of above marks often more or less connected forming two parallel longitudinal vittae. Pronotum with semblance of six longitudinal light brown stripes. Elytra with veins more or less irregularly margined with fuscous. Front dark with light median spot and light arcs.

Structure. Vertex bluntly right angled, female sharper than male; longer than wide. Elytra longer than abdomen in male, shorter in female.

External genitalia. Last ventral segment of female with lateral margins short, posterior margin almost straight with very deep median notch almost severing segment. Male valve roughly triangular, plates slightly wider than valve at base, extending about half the length of pygofer, evenly narrowed to truncate tips, slightly diverging on mesal fifth.

Internal genitalia. Aedeagus in dorsoventral view very slender, evenly tapered to very small triangular tip. Pygofer with very small sharp tooth on lateroventral corner.

Holotype, male, *allotype*, female, and numerous paratypes of both sexes Cochise, Arizona, August 24, 1935, R. H. Beamer.

***Hebecephalus firmus* n. sp.**

Resembling *H. vinculatus* Ball but head more pointed and aedeagus in dorsoventral view broader with two pairs of lateral processes or hooks instead of one. Length 3. mm.

Color. Cinereous with fuscous markings. Vertex usually with anterior and median pair of spots joined on outer ends to form V-shaped marks with their open ends facing in. Basal pair of spots in form of short converging dashes, sometimes double. Pronotum and scutellum more or less irrorate with fuscous. Elytra light with two dark crossbands, one near middle of clavus other near its apex. Venter mostly dark.

Structure. Vertex moderately angled. Width between eyes about one sixth longer than median length. Elytra longer than abdomen in males slightly shorter in females.

External genitalia. Female last ventral segment with lateral angles prominent, posterior margin deeply excavated to two prominent, sharp pointed lobes, divided to their bases but inner margins contiguous. Male valve much broader than long. Plates about as broad as valve at base, lateral margins slightly sinuate to rounded tips, at least three times as long as valve. Pygofer about as long as plates without posterodorsal hook.

Internal genitalia. Aedeagus in dorsoventral view with shaft about four times as long as greatest width, slightly swollen near middle with two pairs of short lateral hooks or processes on apical fourth.

Holotype, male, *allotype*, female, four male and eight female paratypes, Frying Pan Lake, Yellowstone Park, Wyoming, August 15, 1931; R. H. Beamer.

***Hebecephalus vinculatus* (Ball).**

Deltoccephalus vinculatus Ball, E. D. Can. Ent., XXXI, p. 191, 1891.

A Male cotype figured in Plate 15 No. 5 and 5a is here designated lectotype. It was collected by E. D. Ball on the Little Beaver in Colorado and is in his collection.

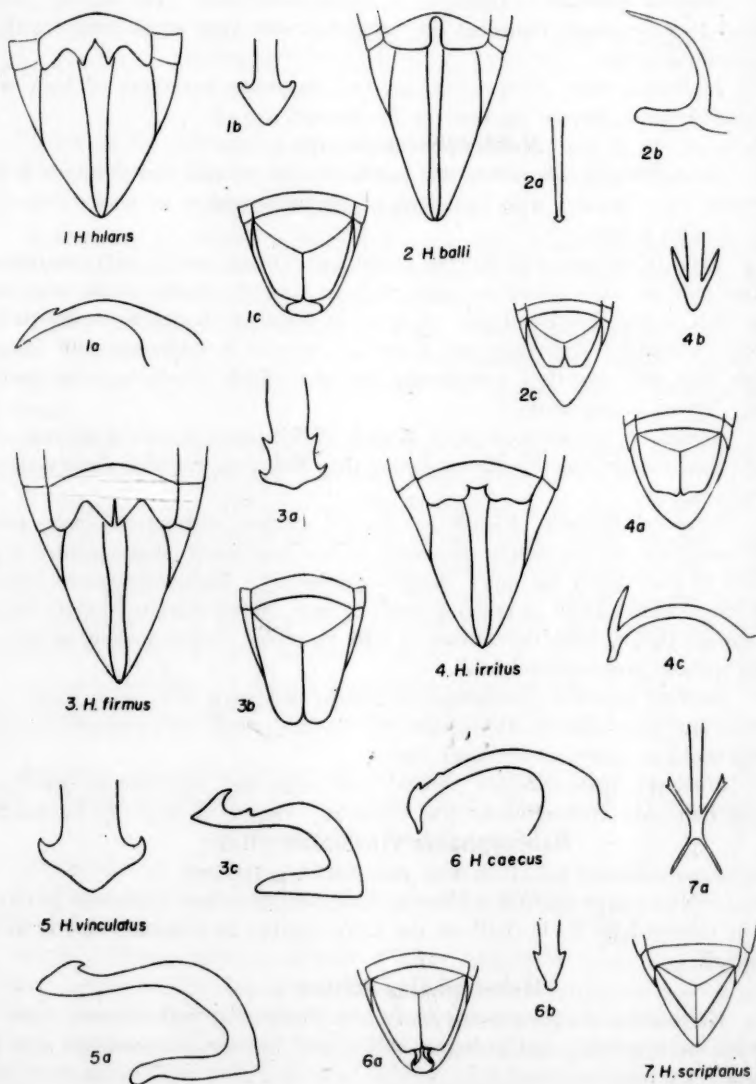
***Hebecephalus irritus* n. sp.**

Resembling *H. adversus* Beamer and Tuthill but with retrorse spine of pygofer much smaller, and aedeagus with a pair of retrorse processes near tip. Length 3-3.5. mm.

Color. Cinereous with fuscous markings. Vertex with usual six spots. Scutellum and pronotum flecked with fuscous. Veins of elytra more or less regularly outlined with fuscous. Venter mostly black except in region of clypeus

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PLATE 15



WESTERN LEAF HOPPERS

and genital segments.

Structure. Vertex broadly rounded, considerably broader than long. Elytra longer than abdomen.

External genitalia. Female last ventral segment with lateral angles prominent, posterior margin shallowly excavated to two prominent rounded lobes separated by a shallow notch about half as deep as in *H. adversus*. Male valve roundly obtuse, much wider than long; plates as wide as valve at base, lateral margins almost straight, to truncate tips, mesal margin longer. Pygofer exceeding plates by about one third their length, hook short, slender, extending posterodorsally.

Internal genitalia. Aedeagus with long shaft, evenly curved dorsally most of its length with a pair of retrorse processes just before tip.

Holotype, male, *allotype*, female and two female and five male paratypes, Winnemucca, Nevada, June 26, 1935; R. H. Beamer.

***Hebecephalus caecus* n. sp.**

Resembling *H. adversus* Beamer and Tuthill but very dark, almost, black, retrorse spine of pygofer large, at least two to three times as large, distinctly visible externally and aedeagus with small sagittate tip. Length 3 mm.

Color. Cinereous with fuscous markings. Vertex with typical three pairs of spots. Pronotum and scutellum heavily irrorate with fuscous. Elytra with veins light, heavily margined with fuscous. Venter almost entirely black.

Structure. Vertex sharply angled, slightly longer than wide. Elytra longer than abdomen.

External genitalia. Male valve more than twice as long as wide. Plate slightly wider than valve at base, lateral margins almost straight to truncate tips. Pygofer with retrorse hook large, two or three times as large as in *H. adversus*.

Internal genitalia. Aedeagus in dorsoventral view long and of medium width, slightly curved dorsally throughout, apex slightly enlarged, sagittate. Apex of style avicéphaliform with three knobbed crest, beak quite long and slender.

Holotype, male, Lapine, Oregon, July 2, 1935; R. H. Beamer.

***Hebecephalus scriptanus* Oman.**

Hebecephalus scriptanus Oman, P. W. Proc. Ent. Soc. Wash., vol. 36 No. 4, April 1934. p. 77.

This species was named from females. Males collected at the type locality are described below.

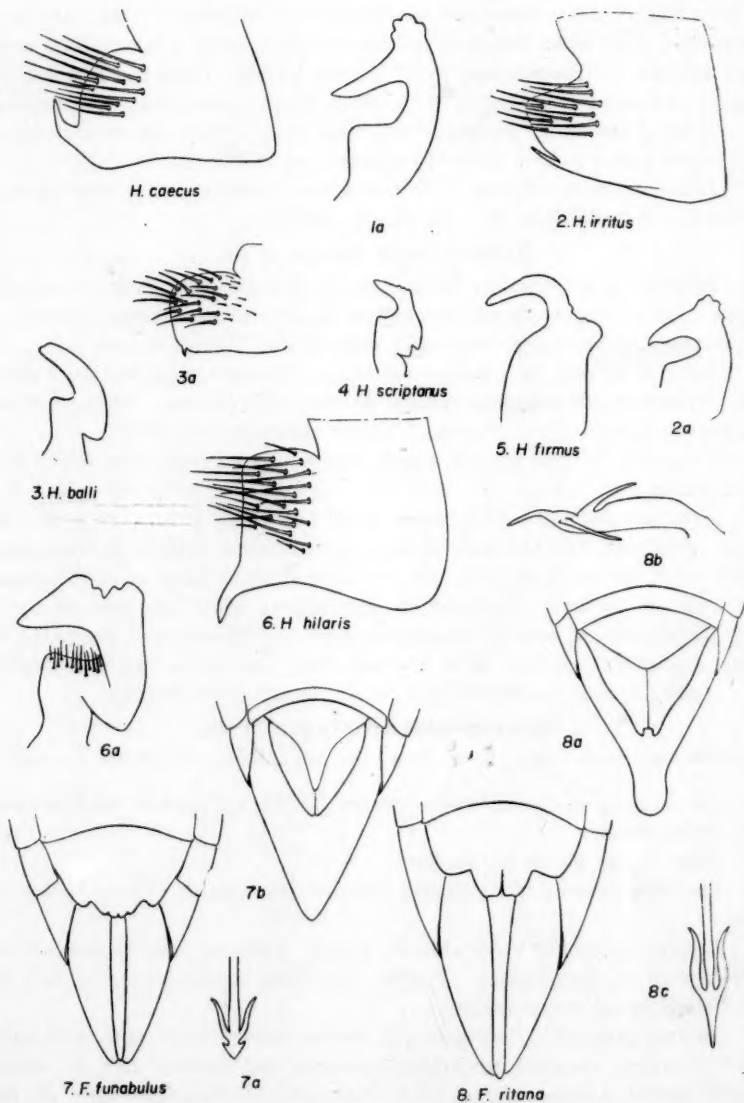
Color. Like female but darker.

Structure. Vertex more bluntly rounded than female. Elytra longer than abdomen.

External genitalia. Valve obtusely angled; plates as wide as valve at base, evenly tapered to sharp apices. Pygofer extending beyond plates by half their length, lateroventral corner smooth.

Internal genitalia. Aedeagus with slender curved shaft, apex with pair of slender diverging, outward projecting processes and another pair of retrorse, diverging, lateral processes slightly more than width of shaft from apex, the latter processes slightly bifid at tip.

Allotype, male and 7 paratypes Mustang Mt., Arizona. August 22, 1935; R. H. Beamer; 1 male Pearce Arizona, August, 23, 1935.



***Flexamia funabulus* (Crumb)**

Deltocephalus funabulus Crumb, S. E. Ann. Ent. Soc. Am. vol. VIII, p. 189, 1915.

This species was placed as a synonym of *Flexamia picta* (Osb.) by DeLong, Ohio State University Studies vol. II p. 32 1926. A dissection of type material reveals a very different aedeagus from that figured in the above paper and also in Ann. Ent. Soc. Am. pp's 106, 108 plate I and III DeLong and Sleesman. Specimens figured in plate 16 Nos. 7, 7a and 7b are here designated Hololecotype and allolectotypes. They are cotypes from Galena, Kansas Oct. 17, 1912; S. E. Crumb.

***Flexamia ritana* n. sp.**

Resembling *F. slossoni* (Ball) but dark coloring of dorsum much lighter, apical cells of elytra about three times as long, male plates much shorter than pygofer and lateral angles of posterior margin of last ventral abdominal segment of female much shorter than median lobes.

Color. General ground color cinereous. Vertex with black dash either side of apex, often basally connected with light brown arcuate line, usually another short black line parallel to margin just in front of ocelli, a pair of transverse dashes on disk opposite ocelli, seemingly the beginning of two almost parallel vittae extending across pronotum and scutellum. Pronotum with an additional pair of vittae on each side. Veins of elytra more or less regularly margined with fuscous. Face to lower margin of eyes black with very definite light arcs. Posterior margin of abdominal segments more or less fuscous.

Structure. Vertex longer than wide, margins straight. Elytra longer than abdomen with truncated apices, as in *F. slossoni*. Apical cells about three times as long as in that species. Length 4-4.5 mm.

External genitalia. Posterior margin of last ventral segment of female evenly rounded to two large, median lobes with truncated apices. Male valve wider than long, plates wider than valve at base, slightly more than half as long as pygofer, with small mesal rectangular notch at apex.

Holotype, male, allotype, female, 11 male and 8 female paratypes Santa Rita Mts., Arizona August 18, 1935; R. H. Beamer.

FURTHER NOTES ON THE SYNONYMY OF NORTH AMERICAN EUPITHECIAS (LEPID., GEOM.)*

BY J. McDUNNOUGH,
Ottawa, Ont.

Through the courtesy of the authorities of the American Museum of Natural History I have been enabled recently to make slides of the genitalia of a number of Pearsall's types of *Eupithecia*, contained in their collections, and also to examine slides of type material made by Mr. S. Cassino. The following new synonymy is based on a careful study of this slide material and a comparison with numerous slides and figures of the genitalia of type material of other authors before me. It continues my work on this genus contained in several papers published in the Canadian Entomologist in 1929-1932.

Eupithecia mutata Pears. Slides of both male and female Types and several

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

male Paratypes have been made. In the males, the claspers of which have unfortunately been somewhat damaged, there appears nothing definite whereby the species can be distinguished from the European *togata* Hbn.; in the female, however, the bursa does not agree very accurately with Petersen's figure of *togata* (1909, Iris, XXII, Pl. V, fig. 20); there is no constriction below the exit of the ductus seminalis and the spining of the fundus is slightly different. For this reason it would appear wise at the present time to retain the name *mutata* for the eastern North American species of the *togata* group.

Eupithecia intimata Pears. Both male and female genitalia show nothing definite whereby they can be separated from *satyrata* Hbn. and the name should be added to the other synonyms I listed previously (1929, Can. Ent. LXI, 64; 1932, *id.* LXIV, 2). Whether eventually we will be able to separate the species on the North American continent into races to which some of the above names will be applicable, cannot be decided at the present time.

Eupithecia promulgata Pears. The type male from New Brighton, Pa. (13.IV. 06) is not conspecific with the type female from the Catskill Mts., N. Y. (23.VI. 07), this latter being referable to *albipunctata* Haw. I would, therefore, restrict the specific name to the above mentioned male type; a female paratype which is now in the U. S. National Museum, after passing through the Merrick and Barnes collections, would appear to be conspecific with the Holotype, according to the genitalic slide which I have kindly been permitted to examine; this specimen should be considered the Allotype. Unfortunately the name *promulgata* as now limited will not stand but falls to *fletcherata* Tayl. I have already pointed out (1929, *op. cit.* 62) the similarity between this species and the European *virgaureata* Dbldy, in the male genitalia, but leave the name *fletcherata* standing at present until European material can be studied.

Eupithecia fortunata Pears. The slides of both male and female genitalia confirm the identity of this species with *obumbrata* Tayl. (1918, B. & McD. Contributions, IV (2) 145). Both names fall to *pygmeata* Hbn. (1929, *op. cit.* 61).

Eupithecia conceptata Pears. According to Cassino (*in litt.*) this species falls to *sierrae* Hlst. I have not examined Hulst's type recently and unfortunately the abdomen is missing so no check on the species can be made by genitalia; however, the type localities are similar and the descriptions, as far as can be told, match fairly well, so there is no reason for not accepting Cassino's reference which was presumably based on a careful examination of types; a female sent me by Cassino under the name *sierrae* agrees in genitalia with Pearsall's female type.

Eupithecia incresata Pears. The tentative reference (*op. cit.* 65) of this species to *nimbicolor* Hlst. (*obscurior* Hlst.) is confirmed by the slides of the genitalia of the type male and female; this latter is practically identical with the figure I recently published (1930, Can. Ent. LXIV, 110).

Eupithecia quakerata Pears. The abdomen of the unique male type had been broken off but was contained in a paper pinned below the specimen; there is every reason to believe that it was the correct abdomen. According to the genitalic slide the species is a good one and the name will take priority over *apacheata* Cass. (1927, Lepid. IV, 60) described from the same general locality; of this latter I

have male and female paratypes before me, received through the courtesy of Dr. N. Banks of the Cambridge Museum of Comparative Zoology, where the Cassino collection is now located.

Eupithecia maestos Hlst. Several years ago I made a slide of the genitalia of the unique female type from Colorado, in the collection of Rutgers College, New Brunswick, N. J. A comparison with other slide material brought out the fact that there was no appreciable difference between the genitalia of *maestos* and that of *harlequinaria* Dyar, concerning which I have already published a note (1929, *op. cit.* 62). The name *maestos* has priority but *harlequinaria* may be used in a subspecific sense for the brighter form from Vancouver Island and, if further splitting is desired, the name *dyarata* Tayl. can be applied to the form from the interior of British Columbia, which is very close to typical *maestos*. The typical Colorado form would appear to extend southward into the higher mountain ranges of Arizona and across into southern California.

Eupithecia valariata Pears. Judging by the genitalia of the type female, of which a slide has been made, this species will fall to *purpurissata* Grossb. from the type female of which a slide of genitalia has also been made; the two Bursae copulatrix are identical. It is possible that both names may be employed in a racial sense when more material is available for study as *purpurissata* was described from Monterey Co. Calif. and *valariata* from the extreme south of the state (San Diego).

Eupithecia brauneata Swett. Through the courtesy of Dr. A. Braun I have been enabled to make a genitalic slide of a paratype female of this species to which the male claspers were adhering, the specimens evidently having been captured *in coitu*. In both sexes I find that the genitalia are identical with those of *russeliata* Sw. described at the same time but with line priority. Judging by the specimen before me, *brauneata* is a much browner-looking form than typical *russeliata*, as it occurs in the New England States; for this reason I imagine the name may be retained for a race of *russeliata*, occurring in the more southerly Appalachian region.

SAY'S GRAIN BUG, *CHLOROCHROA SAYI* STAL., IN CANADA.

BY L. A. JACOBSON,

Dominion Entomological Laboratory, Lethbridge.

Say's grain bug, *Chlorochroa sayi* Stal, made its initial appearance in Alberta, in appreciable numbers, during the season of 1935. The history of the recorded damage by this insect is available in the publication by Caffrey and Barber (U. S. D. A. Bul. 779). This publication is the only adequate treatise to date on this pest of economic grains. The first recorded damage was reported by farmers from Gila and Salt River Valleys of Arizona in 1903. Further outbreaks were recorded in the southern states of New Mexico, Arizona, Texas and Colorado, reaching the peak of depredation during the period, 1915 to 1919. Its first occurrence in Montana was noted during the years 1931 and 1932, where it has been causing considerable losses to the farmers in the northern part of that state ever since. Localized outbreaks were reported in Utah during this same period. In Alberta, the adults were noted on wheat during the months of July and August in the vicinity of Barnwell and Taber. During the fall of 1935, further occurrence

was reported at Coutts, adjoining the International Boundary; east of Medicine Hat; and east of Calgary at Cessford. Hibernating adults were found in varying numbers during the early spring months in the area from Lethbridge east and south to the International Boundary. As the season progressed, nymphs of the first generation were found, this generation maturing about the first week in July. A hurried survey of extreme southern Alberta in July, 1936 shows Say's grain bug to be present in all districts where grains are grown, although at this time there has been no appreciable spread of severe infestation.

The grain bug passes the winter in the adult stage, hibernating under the protection of dead weeds and rubbish or around the bases of large uncut tufts of native grasses. The hibernating adults leave their quarters early in the spring, mate, and lay their eggs soon after. The eggs are laid on the under side of bent stubble and dead weeds where the adults have sought shelter, and on the under side of leaves and branches of their food plants. There are several generations each season, the number being limited by the extent of favourable weather. The course of the seasonal life history under more northern conditions is not known at the present time.

The earlier stages of the insect feed on succulent vegetation, showing a marked preference for mustard and Russian thistle. The fourth and fifth instar nymphs and adults are frequently found on the heads of wheat where they feed by sucking the juices from the growing kernels. This feeding does not affect the appearance of the wheat plant, but either prevents the kernel from forming, or results in a small and shrivelled berry and a corresponding reduction in the subsequent yield. Wheat, barley and rye suffer more from the depredations of Say's grain bug than do any other of its food plants.

At the present time the only recommended control measure is the early spring burning of weeds and rubbish under which the adults pass the winter. Certain cultural methods recommended to control soil drifting have enhanced the prevalence of suitable hibernating quarters, in addition to limiting the use of spring burning. Cropping practice adjusted by dates of seeding appears to be of no value in controlling losses by this insect, since there is considerable overlapping of generations.

A very significant point in the appearance of Say's grain bug in Alberta in 1935 and 1936 is its apparent ability to withstand frigid temperatures while in hibernation. The month of February, 1936, was the coldest on record at Lethbridge, the mean temperature being—10.16 degrees Fahrenheit. Despite this intense cold without any unusual snowfall, the hibernating adults withstood this period with no more than average mortality. Since Western Canada is largely made up of land used for the growing of grains, and Say's grain bug is adapted to survive the winter weather experienced here, the potentiality of this insect as an economic pest is evident.

RESEARCH NOTES

THE MANTID *PARATENODERA SINENSIS* (SAUSS.) IN SOUTHERN QUEBEC.

This note is to report the capture of a fine specimen of *Paratenodera sinensis* (Sauss.) at Longueuil, Que., The insect was taken at light on September

the 14th 1936.

This Mantis, as we all know, was introduced from China, about forty years ago, into the State of Pennsylvania. It has become well naturalized and has spread rapidly into the neighbouring States. It is reasonable to think that the specimen taken at Longueuil is not an adventive, but that the species is now well established in Southern Quebec.

G. CHAGNON.

University of Montreal, Que.

IS *SPHAERIDIUM SCARABOIDES* L. NATIVE TO CANADA?

This dry-land inhabiting genus of Hydrophilidae is represented in North America by two species, both of which are claimed to have been introduced from Europe.

Blatchley, in his *Coleoptera of Indiana* (1914), stated that *scaraboides* had only recently been imported and was scarce in Indiana.

As early as in 1920 F. S. Carr took a few specimens in the vicinity of Edmonton. More recently a few specimens have been taken in widely scattered districts in Alberta, including the Peace River District. The majority were taken under stones but one specimen was found in cattle dung.

Assuming that it is, as claimed, an imported species it must, therefore, have well developed migratory instincts.

On July 25th of this year the writer turned over a single pile of well-worked horse droppings on a mountain side at Nordegg, Alta. (altitude 5000 feet), and found that the soil beneath it was literally permeated with these beetles. In all 113 beetles were collected and it is certain that many were missed.

Neighbouring droppings, which were more fresh and were still moist, were found to be lightly infested. The beetles were burrowing in the dung on which they appeared to have been feeding.

An attempt to locate anything in or under the dung which might prove to be their larvae yielded negative results.

A few of the beetles were placed in a nearby pool of water in order to ascertain whether they showed any of the aquatic characteristics typical of the family to which they belong. They floated on the surface, struggled for a few minutes and then became entirely inactive.

A number were then placed on a hard road, together with some *Philonthus* (Staphylinidae) with which they were associated in the dung. Although the latter immediately escaped from this extremely hot and dry location by flight, *Sphaeridium* made no attempt to do so but ran rapidly in every direction and continued to do so until cover, however small, had been reached. Although their flight wings are well-developed we failed to induce any specimen to fly.

While this does not disprove that they may be highly migratory under certain conditions it does not suggest that, since their supposed introduction into the Eastern States some 25 years ago, they have migrated by flight into such outlying districts as the Peace River District and the mountains of Alberta. On the other hand, their concentration under a single pile of horse droppings suggests some tendency to fly unless all were brothers and sisters which inhabited the place where the eggs, from which they developed, were laid. E. H. STRICKLAND.
University of Alberta.

NEWS AND VIEWS.

FIFTEENTH MEETING OF THE INTERNATIONAL GREAT PLAINS CONFERENCE
OF ENTOMOLOGISTS.

The fifteenth meeting of the I. G. P. C. E. was held at the Dominion Entomological Laboratory, Brandon, Manitoba, on July 28 and 29, 1936, when the local officer in charge, Dr. R. D. Bird, acted as host and secretary. The meeting, which was opened by the president, Prof. A. G. Ruggles, was the first to be held in Canada since the death of the beloved late president and founder of the conference, Mr. Norman Criddle. Thirty-five delegates were in attendance including representatives from the four western Canadian provinces, Minnesota, Wisconsin, Nebraska, North Dakota, South Dakota, Montana, and District of Columbia. The program, as is customary, included reports on the insect pests of the season from each state and province. A symposium on "Methods of Insect Survey and Their Applications" included the following papers:

Insect Surveys and Their Application by J. A. Munro, State Ent., Fargo, N. Dak.

Survey Methods Used for the Pale Western Cutworm by H. L. Seamans, Ent. Br., Lethbridge, Alta.

Survey Methods Used for Western Wheat Stem Sawfly by C. W. Farstad, Ent. Br., Lethbridge, Alta.

Survey Methods for Potato Psyllid by G. F. Manson, Ent. Br. Lethbridge, Alta.

Surveying for Red-Backed Cutworm by K. M. King, Ent. Br., Saskatoon, Sask.

Methods of Surveying for Insect Parasitism by C. W. Smith, Ent. Br. Belleville, Ont.

Surveying for Wireworms by K. M. King, Ent. Br., Saskatoon, Sask.

Additional papers were presented on the following subjects:

The Place of Demonstrations and Illustrative Materials in the Programs of the I.G.P.C.E. by H. C. Severin, S. Dak. Agric. College, Brookings, S. Dak.

Biology and Control of the Spruce Mite, *Paratetranychus ununguis* Jac by K. E. Stewart, Ent. Br., Indian Head, Sask.

An Appraisal of the Economics of Grasshopper Control Methods in Saskatchewan, by L. C. Paul, Ent. Br., Saskatoon, Sask.

Blister Beetles in South Dakota by Geo. Gilbertson, S. Dak. Agric. College, Brookings, S. Dak.

Round table and "lobby" discussions were held and the meeting was generally voted as being one of the most profitable gatherings of the group. The majority of the delegates stayed over to attend a meeting of the Canadian Committee on Grasshopper Research which was held at the Brandon Laboratory July 30 and August 1.

R. D. BIRD.

Dominion Entomological Laboratory, Brandon, Man.

Mailed Saturday, December 5th, 1936.

